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ABSTRACT

This is the last of six guidebooks setting minimum course content for first-year algebra; it covers algebraic and graphic solutions to systems of equations, relations and functions, and variation. After course goals are stated and performance objectives listed, a course outline, textbook references, and teaching suggestions are given. Pretest and posttest items are included along with an annotated bibliography of seven references. For other booklets in this algebra series, see ED 067 283, ED 067 284, ED 067 296, and SE 016 504. (DT)

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AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

DADE COUNTY PUBLIC SCHOOLS

SE016 505

Algebra 1 u

5215.16

Mathematics

DIVISION OF INSTRUCTION • 1971

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QUINMESTER MATHEMATICS

COURSE OF STUDY

FOR

ALGEBRA 1 u

5215.16

(EXPERIMENTAL)

Written by

Muriel Weathers

for the

DIVISION OF INSTRUCTION
Dade County Public Schools
Miami, Florida 33132
1971-72

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PREFACE

The following course of study has been designed to set a minimum standard for student performance after exposure to the material described and to specify sources which can be the basis for the planning of daily activities by the teacher. There has been no attempt to prescribe teaching strategies; those strategies listed are merely suggestions which have proved successful at some time for some class.

The course sequence is suggested as a guide; an individual teacher should feel free to rearrange the sequence whenever other alternatives seem more desirable. Since the course content represents a minimum, a teacher should feel free to add to the content specified.

Any comments and/or suggestions which will help to improve the existing curriculum will be appreciated. Please direct your remarks to the Consultant for Mathematics.

All courses of study have been edited by a subcommittee of the Mathematics Advisory Committee.

CATALOGUE DESCRIPTION

Further work in solving equations and an introduction to functions. Includes the algebraic and graphic solutions to systems of equations, functions, and work with variation.

Designed for the student who has mastered the skills and concepts of Algebra 1t.

TABLE OF CONTENTS

	Page
Goals	3
Key to References	3
Performance Objectives	4
Course Outline	5
Textbook References	6
Suggested Strategies	7
Sample Pretest Items	8
Sample Posttest Items	11

OVERALL GOALS

The student will:

1. Develop further understanding and skill in graphing.
2. Develop the ability to solve pairs of linear open sentences.
3. Use pairs of linear equations in the solution of verbal problems.
4. Be introduced to relations and functions with their related vocabulary and symbolism.
5. Be introduced to quadratic functions through graphing.

KEY TO REFERENCES

(* State Adopted)

* D - Dolciani, Mary; Wooten, William; Beckenbach, Edwin; Jurgensen, Ray; and Donnelly, Alfred. Modern School Mathematics, Algebra 1. New York: Houghton Mifflin, 1967.

N - Nichols, Eugene D.. Modern Elementary Algebra. New York: Holt, Rinehart, and Winston, 1961.

* PL - Payne, Joseph; Zamboni, Floyd; and Lankford, Francis. Algebra One. New York: Harcourt, Brace, and World, Inc., 1969.

* PA - Pearson, Helen R. and Allen, Frank B. Modern Algebra: A Logical Approach, Book One. Boston: Ginn and Co., 1964.

[1] - The number in the block preceeding an objective indicates the number of the state assessment standard to which the objective is related.

PERFORMANCE OBJECTIVES

I. Linear Open Sentences in Two Variables

The student will:

[6] 1. Solve a system of linear equations by graphing.

[6] 2. Solve a linear system by addition.

[6] 3. Solve a linear system by substitution.

[12] 4. Solve problems using a system of equations.

5. Graph systems of linear inequalities.

II. Relations and Functions

The student will:

[11] 1. Distinguish between a relation and a function.

[11] 2. Distinguish between the graph of a relation and the graph of a function.

3. Identify the domain and range of a relation or function.

4. Evaluate $f(x)$ for a given value of x.

5. Identify a constant, a linear and a quadratic function from their graphs and from their rules.

6. Identify direct variations, inverse variations, and proportions from their rules.

[12] 7. Solve problems involving direct variation, inverse variation, and proportion.

8. Graph a quadratic function of the form $f(x) = ax^2 + c$.

9. Find the zeros of linear and quadratic functions algebraically and graphically.

COURSE OUTLINE

Related Objective	
I.	I. Linear Open Sentences in Two Variables
	A. Solving by different methods
1.	1. graphing
2.	2. addition
3.	3. substitution
4.	B. Solving word problems
5.	C. Graphing linear inequalities
II.	II. Relations and Functions
1.	A. Distinguishing between a relation and a function
	1. given ordered pairs
2.	2. given graphs
3.	B. Identifying the domain and range of a relation or function
4.	C. Evaluating functions
5.	D. Indentifying constant, linear, and quadratic functions
	1. given a graph
	2. given a rule
	E. Direct variations, inverse variations, and proportion
6.	1. identification given a rule
7.	2. solution of problems
8.	F. Graphing a quadratic function
9.	G. Finding zeros of linear and quadratic functions
	1. algebraically
	2. graphically

TEXTBOOK REFERENCES

Text	Course Outline	
	I	II
D	223-253	377-416
N	268-281 293-311	393-419 (omits II E)
PL	219-250	196-208 350-358 461-484
PA	465-492	542-569 588-590

STRATEGIES

Keep in mind that the objectives are minimum. The textbooks include considerable material that is not mentioned here. How much you cover should depend upon the ability level of your students.

IA. Although it is not required here that the student be able to identify dependent and independent equations, he should be made aware that all pairs of equations don't have a point in common. This of course is most easily recognized when solving equations by graphing.

All three methods of solving pairs of equations should be stressed because the techniques involved are used later.

IB. Many students find solving verbal problems easier using two variables. They should be given sufficient opportunity to develop this skill. If time permits, redoing word problems previously done using one variable is sometimes helpful.

II. On the topic of relations and functions, the notation used in the different text varies. Although learning the notation is an important part of this topic, it might be best to stick to the notation in the text being used at this level. In considering the post-test, realize that some of the notation might need to be changed to correspond to your text.

IIA. Encourage the students to develop for themselves the "vertical line test" for determining if a graph represents a function.

IIB. The use of graphs in the identification of the domain and range is helpful since it presents a picture of both.

IIE. The study of variation and proportion should be stressed since its applications are widespread in science and everyday problems.

SAMPLE PRETEST ITEMS

DIRECTIONS: For multiple choice and matching questions, in which you will be asked to select one of several alternatives, write the letter corresponding to the answer you select.

Questions 1-4 refer to figure 1.

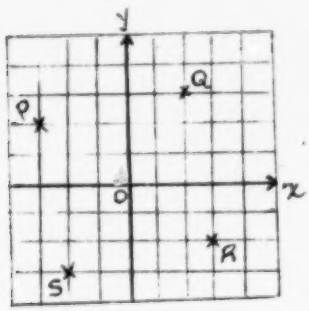


figure 1

1. P is the graph of

   (A) (-3, 2)
   (B) (-2, 3)
   (C) (2, -3)
   (D) (3, -2)

2. Which point has coordinates (3, -2)?

3. Which point has an abscissa of -2?

4. The point S is in quadrant ?

Questions 5-8 refer to figure 2.

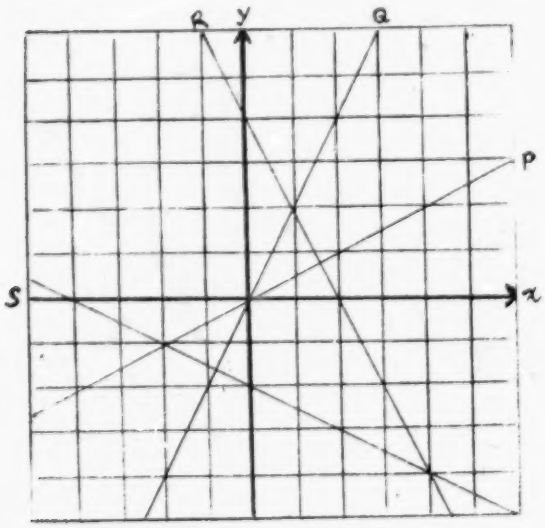


figure 2

5. The slope of line P is

   (A) $\frac{1}{2}$

   (B) $-\frac{1}{2}$

   (C) 2

   (D) -2

6. Which line has slope of -2?

7. What is the x-intercept of line R?

8. What are the coordinates of the point at which P and S intersect?

9. The slope-intercept form of the equation $2x + 3y = 6$ is

   (A) $3y = 6 - 2x$
   (B) $y = -\frac{2}{3}x + 2$
   (C) $2x + 3y - 6 = 0$
   (D) $2x = -3y + 6$

In questions 10-12, indicate (a) the slope and (b) the y-intercept of the lines whose equations are given.

10. $y = 2x + 3$

11. $x + y = 1$

12. $5x - 2y = 8$

13. The equation of a line with slope 3 and y-intercept - 2 would be

(A) $x = 3y - 2$ (C) $y = -2x + 3$

(B) $x = -3y + 2$ (D) $y = 3x - 2$

14. Write an equation of the line through points (1, -2) and (2, 1).

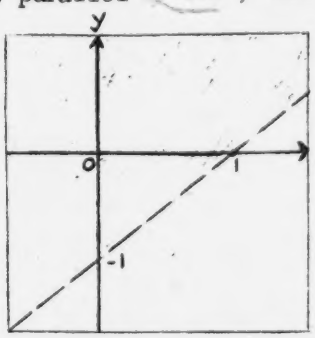
15. The equation of a line with slope $\frac{1}{2}$ that contains the point (3, 2) would be

(A) $y = \frac{1}{2}x + 2$ (C) $2y - x = 4$

(B) $2y = x - 1$ (D) $2y = x + 1$

16. The graph of $y = -2$ is

(A) parallel to the x-axis and 2 units above it
(B) parallel to the x-axis and 2 units below it
(C) parallel to the y-axis and 2 units to the right of it
(D) parallel to the y-axis and 2 units to the left of it



17. The shaded portion of the figure at the left is the graph of

(A) $y > x - 1$
(B) $y \geq x - 1$
(C) $y < x - 1$
(D) $y \leq x - 1$

18. The strip between and including the lines $x = -1$ and $x = 1$ is the graph of graph of

(A) $|x| < 1$
(B) $|x| > 1$
(C) $|x| \leq 1$
(D) $|x| \geq 1$

PRETEST - ANSWER KEY

1. A
2. R
3. S
4. III
5. A
6. R
7. (0, 2)
8. (-2, -1)
9. B
10. (a) 2 (b) 3
11. (a) -1 (b) 1
12. (a) $\frac{5}{2}$ (b) -4
13. D
14. $-3x + 2y = -5$
15. D
16. B
17. A
18. C

SAMPLE POSTTEST ITEMS

I. In questions 1-3, solve the pairs of equations using the method indicated.

1. $2y - x = -5$
   $y - 3x = -5$
   by graphing

2. $2x + 3y = 5$
   $3x + 2y = 0$
   by addition

3. $m = 7n - 5$
   $n = 3m - 25$
   by substitution

In question 4, A and B, use two variables and a pair of equations to solve each problem.

4. A. The sum of two numbers is 61. Their differences is 29. Find the numbers.

   B. The perimeter of a rectangle is 78 inches. The length exceeds the width by 11 inches. Find the dimensions.

5. Graph each inequality, using a dashed line when the points of the boundary line are not solutions of the inequality. Then shade the region that represents the solution set of the system.

   $y < 2x - 1$
   $y > \frac{1}{2}x - 1$

II. 1. Which of the relations described below are functions?

   A. $\{(-2, 3), (-3, 4), (-4, 5)\}$

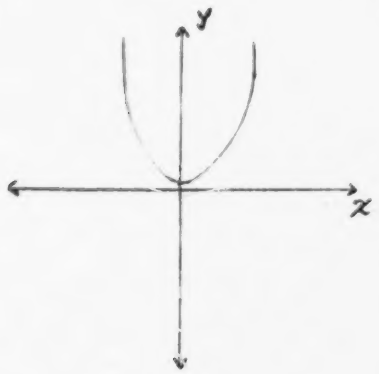
   B. $\{(-4, 6), (-4, 2), (-4, 1)\}$

   C. $\{(x, y) | y = 3x + 4\}$

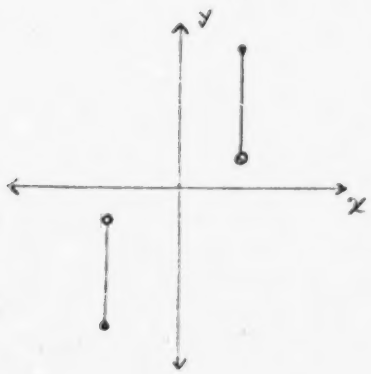
   D. $\{(x, y) | x = y^2\}$

2. Which of the relations shown on the graphs below are functions?

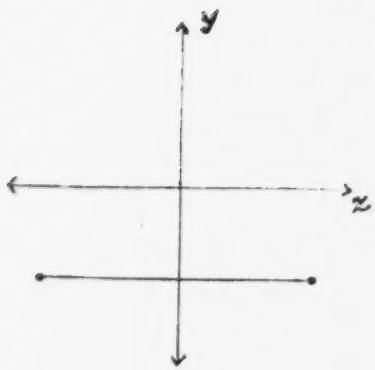
A.



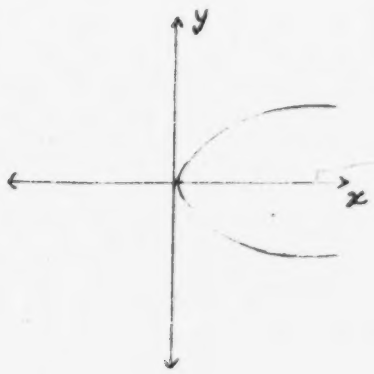
B.



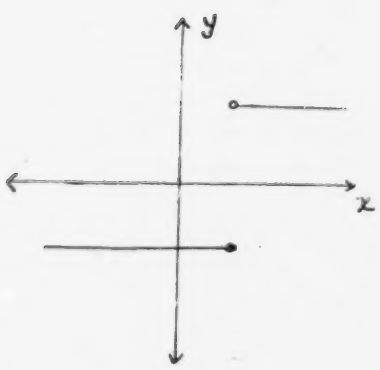
C.



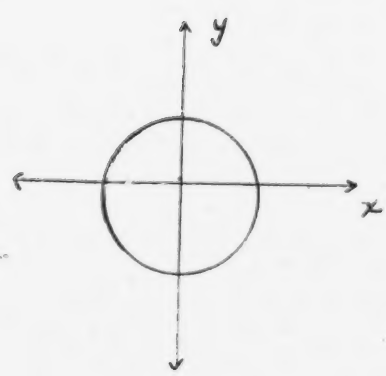
D.



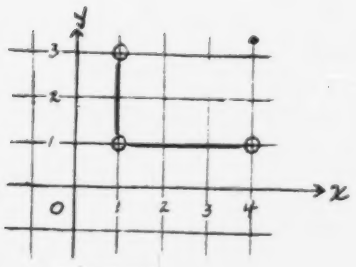
E.



F.



3. Questions A and B refer to the relation whose graph is shown at the left.



A. The domain of the relation is ?

(a) $\{1\}$
(b) $\{1, 4\}$
(c) {real numbers between 1 and 3}
(d) {real numbers between 1 and 4}
(e) none of these

B. The range of the relation is ?

(a) $\{1\}$
(b) $\{1, 4\}$
(c) {real numbers between 1 and 3}
(d) {real numbers between 1 and 4}
(e) none of these

In questions C, D, and E, give the missing information for each of the functions.

	Domain	Range	Formula
C.	$\{1, 3, 5\}$	?	$y = 2x - 3$
D.	?	$\{1, 3, 5\}$	$y = 2x - 1$
E.	$\{-1, 0, 1\}$	?	$y = x - \|x\|$

4. If $f(x) = 4x^2 - x$, find the real number represented by

A. $f(0)$ B. $f(-1)$ C. $f(2t)$

5. A. Which of the following equations describe linear functions?

(a) $y = -2x + 3$
(b) $y = x - 2$
(c) $y = \frac{1}{x}$
(d) $y - x = 3$

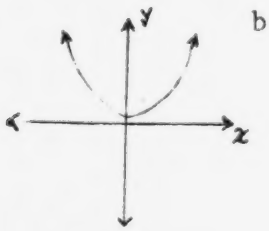
B. Which of the following equations describe constant functions?

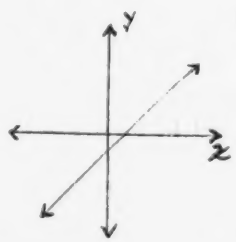
(a) $y = x$
(b) $y = 2$
(c) $x = 2$
(d) $y - x = 4 - x$

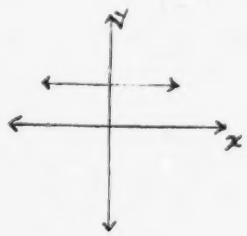
C. Which of the following equations describe quadratic functions ?

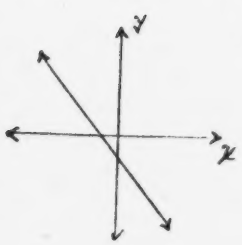
(a) $y = x$
(b) $y = x^2$
(c) $y = x^2 + 3$
(d) $y = \frac{1}{x}$

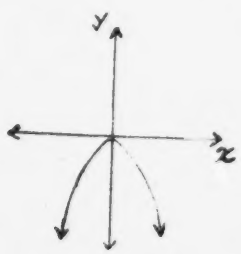
D. Identify the following as graphs of (c) constant, (L) linear or (q) quadratic functions.

a. 

b. 

c. 

d. 

e. 

6. Indicate whether the following describe a (d) direct variation or (i) an inverse variation.

A. $xy = 10$

B. $m = \frac{10}{n}$

C. $d = 10t$

D. $10d = t$

E. $m = \frac{n}{10}$

7. A. If y varies directly as x, and $y = 6$ when $x = 5$, what is y when $x = 6$?

B. A person's shadow varies directly as his height. If a 6-foot man casts a 4-foot shadow, how high is a building which casts a 120-foot shadow at the same hour?

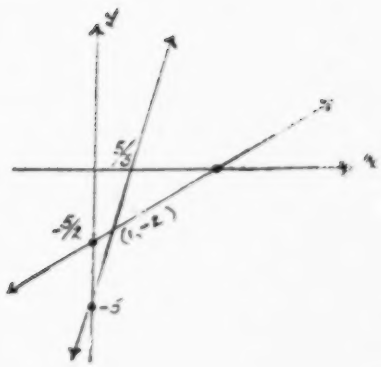
C. If y varies inversely as x^2 and y = 6 when x = 7, what is y when x = 6?

D. If (x + 1) varies inversely as (y - 2) and y = 5 when x = 3, for what value of x does y = 3?

8,9. Plot the graph of $f(x) = 2x^2 + 8$ and give the zero of the function, if any.

POSTTEST ANSWER KEY

I. 1.



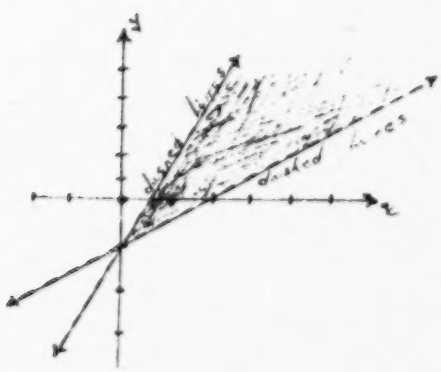
2. (-2, 3)

3. m = 9, n = 2

4. A. 45, 16

   B. w = 14 in., l = 25 in.

5.



II. 1. A, C

2. A, C, E

3. A. e.

   B. e.

   C. $\{-1, 3, 7\}$

   D. $\{1, 2, 3\}$

E. $\{-2, 0\}$

4. A. 0

B. 5

C. $16t^2 - 2t$

5. A. a, b, d

B. b, d

C. b, c

Da. q

b. L

c. c

d. L

e. q

6. A. i

B. i

C. d

D. d

E. d

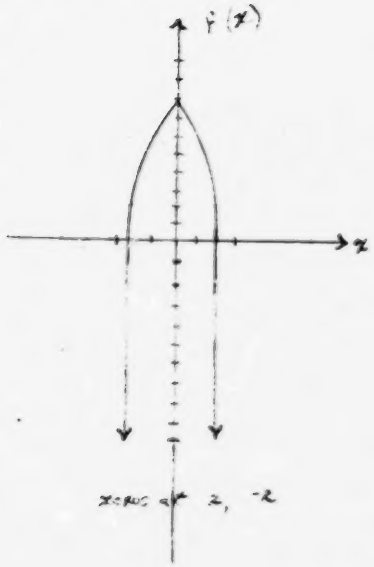
7. A. $7\frac{1}{5}$

B. 180 ft.

C. $8\frac{1}{6}$

D. 11

8, 9.



ANNOTATED BIBLIOGRAPHY

Eason, Oliver W. Graphing Pictures. Portland, Maine: J. Weston Walch, Publisher, 1966.

Contains 25 sets of linear equations which make pictures when graphed. Good for interest and practice in graphing.

Dressler, Isidore. Ninth Year Mathematics. New York: Amsco School Publications, Inc., 1966.

Pages 360-440 covers graphing of linear equations, proportions, and variation in review form with many appropriate exercises.

Heimer, Ralph T.; Kocher, Frank; and Lutzes, John J. A Program in Contemporary Algebra. New York: Holt, Rinehart and Winston, Inc., 1963.

Book 3 of this programmed series covers equations and inequalities in two variables. The last 2 units of Book 4 cover functions and relations.

Drooyan, Irving and Wooton, William. Programmed Beginning Algebra. New York: John Wiley and Sons, Inc., 1963.

This is the sixth book in an eight book sequence that covers the material of Algebra 1. Would be useful for students who have been absent or students who need additional work with graphing. Covers graphing of linear equations and inequalities, solving of simultaneous equations, and word problems.

Jacobs, Russell F. Introductory Algebra 2. New York: Harcourt, Brace and World, Inc., 1969.

Excellent development for the slower student or the student working on his own in the areas of relations, functions, solutions of simultaneous linear equations, graphing of linear functions, quadratic functions, and linear inequalities.

Peters, Max and Schaaf, William L. Algebra, A Modern Approach, Book 1. Princeton, New Jersey: D. Van Nostrand Company, Inc., 1968.

Includes a good section on direct and inverse variation which contains a number of word problems.

Fitzgerald, William M.; Zetterberg, Jack P.; and Dalton, LeRoy C.. Algebra 1, Theory and Application. River Forest, Illinois: Laidlaw Brothers Publishers, 1967.

Graphing is introduced through development of the concept of Cartesian products. First work in graphing is presented with the Cartesian product I X I, and later expanded to Q X Q.